## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 16-27, and 34 rejected under 35 U.S.C. 103(a) as being unpatentable over Hung et al [6339925], further in view of Pfefferle et al [6048194].

4. With respect to claim 16, Hung discloses a method of combusting a dual gas/liquid fuel in a catalytic combustion system, comprising: providing a catalytic burner (20, 26) in a combustion air flow with a dual gas or liquid fluid fuel supply positioned upstream of a fuel outlet of a primary burner with respect to the direction of the combustion air flow [see FIG 1, col 3, line 5-14]; reacting the fuel in a catalytic pre-reaction by exposing the fuel and the air flow to the catalytic burner [col 3, line 14-19]; and continuing to burn the pre-reacted fuel in a secondary reaction located downstream of the pre-reaction [col 3, line 20-24], however does not disclose the swirling component

as further claimed. Pfefferle teaches a similar device wherein a fuel/air mixture is directed through a swirler (50) having a catalytic component (70, 80) which then allows for the directing the pre-reacted fuel and air flow via a swirling component into a flow channel at an angle of 15° to 75° relative to the direction of combustion air flow [see FIG 2, col 3, line 46-53, line 59-67, col 4, line 1-10, line 44-65]. In view of Pfefferle, a swirler directs pre-reacted fuel at an angle inherently in the range claimed based on the formulation of the swirl number and tangential velocities. It would have been obvious to a person of ordinary skill in the art at the time of the invention to provide a swirling component because the technique was known in the art, yielding the predictable result of lowering NOx emissions by lowering burner temperature.

5. With respect to claim 17, Hung discloses the method as claimed in claim 16, wherein the pre-reacted fuel flow is directed into a combustion space [col 3, line 25-33, line 43-53], however does not disclose the creation of the vortex. Pfefferle teaches a similar device where a vortex is created, and the secondary reaction occurs in the vortex [see FIG 2, col 3, line 46-53, line 59-67, col 4, line 1-10, line 44-65]. In view of Pfefferle, the secondary reaction occurs in the vortex. It would have been obvious to a person of ordinary skill in the art at the time of the invention to provide a swirling component because the technique was known in the art, yielding the predictable result of lowering NOx emissions by lowering burner temperature.

6. With respect to claim 18, Hung discloses the method as claimed in claim 17, however does not disclose the length of the burner depending on the dwell time of the pre-reacted fuel. Pfefferle teaches a similar device wherein the combined length of the

catalytic burner, primary burner and combustion space are determined based on a dwell time of the pre-reacted fuel [col 1, line 35-40]. In view of Pfefferle, the identification of the problem of a short channel limiting catalyst residence time shows the awareness of having the length of the burner depend on the dwell time. It would have been obvious to a person of ordinary skill in the art at the time of the invention to have the combined length of the device based on the dwell time of the pre-reacted fuel because it was known that the length of has an effect on the residence time of the catalyst reaction, therein showing that varying the length varies the catalyst reaction.

7. With respect to claim 19, Hung discloses the method as claimed in claim 18, wherein the catalytic burner (20, 25), primary burner (19) and combustion space (13) are arranged next to each other in sequence along a path of the air flow [see FIG 1].

8. With respect to claim 20, Hung discloses the method as claimed in claim 19, however does not disclose the secondary reaction as further claimed. Pfefferle teaches a similar method wherein the secondary reaction is a homogeneous non-catalytic reaction [see abstract]. It would have been obvious to a person of ordinary skill in the art at the time of the invention to have a secondary reaction as claimed because the technique was known in the art, yielding the predictable result of limiting NOx formation.

9. With respect to claim 21, Hung discloses the method as claimed in claim 20, wherein the fuel is completely burned in the secondary reaction [col 3, line 54-61].

10. With respect to claim 22, Hung discloses the method as claimed in claim 21, wherein the dual gas/liquid fuel is either a fuel gas or a fuel oil [see FIGs 3A, 3B, col 4, line 33-54]. The use of methane suggests a fuel gas.

11. With respect to claim 23, Hung discloses the method as claimed in claim 22, wherein the fuel is a fuel gas during a first operating mode of the catalytic combustion system [col 3, line 54-61], however does not disclose the second operation mode as claimed. This, however is believed to be well known in the art to have different operation modes that with respective fuels, therefore it would have been obvious to a person of ordinary skill the art to have a second operating mode wherein a fuel is a fuel oil during a second operating mode catalytic combustion system because this feature offers versatility which is a common goal through innovation.

12. With respect to claim 24, Hung discloses a bumer (10) for burning a dual gas/liquid fuel, comprising: a primary burner (14, 19) having a dual gas/liquid fuel inlet and a dual gas/liquid fuel outlet [see FIG 1]; and a catalytic burner (20, 26) located within a combustion air flow channel, having a catalytically effective element (25), wherein a fuel outlet of the catalytic burner is positioned upstream of the fuel outlet of the primary burner with respect to the direction of flow of the fuel within the flow channel and the fuel is catalytically reacted via exposure to the catalytically effective element [see FIG 1, col 3, line 5-24], however does not disclose a burner creating a vortex. Pfefferle teaches a similar device having a catalytically effective element (50) arranged to direct the pre-reacted fuel and air flow at an angle between 15° to 75° relative to the direction of flow to create a vortex in the flow channel [see FIG 2, col 3, line 46-53, line 59-67, col 4, line 1-10, line 44-65]. In view of Pfefferle, a swirler directs pre-reacted fuel at an angle inherently in the range claimed based on the formulation of the swirl number and tangential velocities. It would have been obvious to a person of ordinary skill in the

art at the time of the invention to provide a swirling component because the technique was known in the art, yielding the predictable result of lowering NOx emissions by lowering burner temperature.

13. With respect to claim 25, Hung discloses the burner as claimed in claim 24, wherein the fuel is a fuel gas during a first operating mode of the catalytic burner [col 3, line 54-61] however does not disclose the second operation mode as claimed. This, however is believed to be well known in the art to have different operation modes that with respective fuels, therefore it would have been obvious to a person of ordinary skill the art to have a second operating mode wherein a fuel is a fuel oil during a second operating mode catalytic combustion system because this feature offers versatility which is a common goal through innovation.

14. With respect to claim 26, Hung discloses the burner as claimed in claim 25, wherein the catalytic burner has a plurality of catalytically effective elements [see FIG 4, col 5, line 21-54].

15. With respect to claim 27, Hung discloses the burner as claimed in claim 26, wherein the catalytically effective element is a honeycomb catalytic converter [see FIG 5].

16. With respect to claim 34, Hung discloses a combustion chamber for a dual gas/liquid fuel gas turbine engine, comprising: a combustion chamber housing having an inward side and an outward side; a combustion chamber wall (12) formed on the inward side of the combustion chamber; a plurality of heat resistant elements affixed to an interior of the combustion chamber wall that define a combustion air flow channel

(24) [see FIG 1]; a primary burner (14, 19) having a dual fuel outlet; and a catalytic burner located within the combustion air flow channel having a plurality of catalytically effective elements (25), wherein a fuel outlet of the catalytic burner (20, 26) is positioned upstream of the primary burner fuel outlet with respect to the direction of flow of a fuel within the flow channel and the fuel is catalytically pre-reacted by exposure to the catalytically effective element and subsequently a homogeneous non-catalytic secondary reaction is ignited downstream of the primary burner fuel outlet [see abstract, FIG 1, col 3, line 5-24], however does not disclose the inclination of the catalytically effective elements. Pfefferel teaches a similar device wherein the catalytically effective elements are inclined at an angle between 15° and 75" to create a vortex in the flow channel [see FIG 2, col 3, line 46-53, line 59-67, col 4, line 1-10, line 44-65]. In view of Pfefferle, a swirler directs pre-reacted fuel at an angle inherently in the range claimed based on the formulation of the swirl number and tangential velocities. It would have been obvious to a person of ordinary skill in the art at the time of the invention to provide a swirling component because the technique was known in the art, yielding the predictable result of lowering NOx emissions by lowering burner temperature.

17. With respect to claim 35, Hung discloses the combustion chamber as claimed in claim 34, wherein the fuel is either a fuel gas or a fuel oil [see FIGs 3A, 3B, col 4, line 33-54]. The use of methane suggests a fuel gas.

18. Claims 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung [‘925], in view of Pfefferle et al [‘194], further in view of McCarty et al [6015285].

19. With respect to claim 28, Hung discloses the burner as claimed in claim 27, wherein there is a honeycomb catalytic converter, however does not disclose the components as claimed.

20. With respect to claim 29, Hung discloses the burner as claimed in claim 28, wherein there is a honeycomb catalytic converter, however does not disclose the components as further claimed.

21. With regard to claims 28 and 29, Hung disclose the burner as claimed, however McCarty teaches a similar device wherein the honeycomb catalytic converter basic component is selected from the group consisting of titanium dioxide, silicon oxide and zirconium oxide [col 7, line 66-67, col 8, line 32-40] and wherein the honeycomb catalytic converter catalytically active component is a noble metal or metal oxide which has an oxidizing effect on the fluid fuel [see table 2]. In view of McCarty, the honeycomb structure acts as a catalyst which inherently would have an oxidizing effect on the fluid fuels based on the components of the honeycomb. It would have been obvious to a person of ordinary skill in the art at the time of the invention to have the honeycomb components as claimed because the option was known in the art, yielding the predictable result of having an oxidizing effect on the fuel so that there can be a reduction in NOx and CO emissions.

22. With respect to claim 30, Hung discloses the burner as claimed in claim 29, however does not disclose the vortex creation as further claimed.

23. With respect to claim 31, Hung discloses the burner as claimed in claim 30, however does not disclose the perpendicular arrangement of the catalytically effective elements as further claimed.

24. With regard to claims 30 and 31, Hung discloses the burner as claimed, however Pfefferle teaches a similar device wherein the vortex created by the catalytically effective elements is located downstream of the primary burner fuel outlet [see FIG 2, col 3, line 46-53, line 59-67, col 4, line 1-10, line 44-65] and wherein the catalytically effective elements are arranged in a plane perpendicular to the direction of flow, and the fuel outlet of the catalytically effective elements discharges into the flow channel [see FIG 2, col 3, line 46-53, line 59-67, col 4, line 1-10, line 44-65]. In view of Pfefferle, a vortex is created and the fuel is discharged into the flow channel as claimed. It would have been obvious to a person of ordinary skill in the art at the time of the invention to provide a vortex component because the technique was known in the art, yielding the predictable result of lowering NOx emissions by lowering burner temperature.

25. With respect to claim 32, Hung discloses the method as claimed in claim 31, however does not disclose the length of the burner depending on the dwell time of the pre-reacted fuel. Pfefferle teaches a similar device wherein the combined length of the catalytic burner, primary burner and combustion space are determined based on a dwell time of the pre-reacted fuel [col 1, line 35-40]. In view of Pfefferle, the identification of the problem of a short channel limiting catalyst residence time shows the awareness of having the length of the burner depend on the dwell time. It would have been obvious to a person of ordinary skill in the art at the time of the invention to have the combined

length of the device based on the dwell time of the pre-reacted fuel because it was known that the length of has an effect on the residence time of the catalyst reaction, therein showing that varying the length varies the catalyst reaction.

26. With respect to claim 33, Hung discloses he burner as claimed in claim 32, wherein the catalytic burner (20, 25), primary burner (19) and flow channel are arranged next to each other in sequence along a path of the air flow [see FIG 1].

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AVINASH SAVANI whose telephone number is (571)270-3762. The examiner can normally be reached on Monday- Friday, alternate Fridays off, 7:30-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven McAllister can be reached on 571-272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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